

Solutions to Discrete Structures Sample Quiz on Number Bases

1. Write the decimal number $(22)_{10}$ in its binary (base-2) and its ternary (base-3) representations.

$$\begin{aligned} 22 &= 16 + 4 + 2 \\ &= 1 \cdot 2^4 + 0 \cdot 2^3 + 1 \cdot 2^2 + 1 \cdot 2^1 + 0 \cdot 2^0 \\ \implies (22)_{10} &= (10110)_2 \end{aligned}$$

$$\begin{aligned} 22 &= 2 \cdot 9 + 3 + 1 \\ &= 2 \cdot 3^2 + 1 \cdot 3^1 + 1 \cdot 3^0 \\ \implies (22)_{10} &= (211)_3 \end{aligned}$$

2. Write the decimal numbers $(1)_{10}, (2)_{10}, \dots, (12)_{10}$ in their base-4 representation.

1, 2, 3, 10, 11, 12, 13, 20, 21, 22, 23, 30

3. Which number is larger $(321)_4$ or $(111001)_2$?

$$\begin{aligned} (321)_4 &= 3 \cdot 4^2 + 2 \cdot 4^1 + 1 \cdot 4^0 \\ &= 48 + 8 + 1 \\ &= 57 \end{aligned}$$

$$\begin{aligned} (111001)_2 &= 1 \cdot 2^5 + 1 \cdot 2^4 + 1 \cdot 2^3 + 0 \cdot 2^2 + 0 \cdot 2^1 + 1 \cdot 2^0 \\ &= 32 + 16 + 8 + 1 \\ &= 57 \end{aligned}$$

4. In the base-13 system: $A = 10$, $B = 11$, and $C = 12$. What is the decimal value of the number $(CAB)_{13}$?

$$\begin{aligned} (CAB)_{13} &= 12 \cdot 13^2 + 10 \cdot 13^1 + 11 \cdot 13^0 \\ &= 2028 + 130 + 11 \\ &= (2169)_{10} \end{aligned}$$